

Abstract of the Disc l sur

Significant advances in semiconductor microelectronics technologies have resulted in greatly enhanced chip performance. Systems studies have continuously shown that on-board interconnects between chips are the bottleneck in achieving board level performance that is comparable with this chip performance. This invention provides a multiple-layer photonic-electronic circuit board family that solves this interconnect performance problem. Multiple layers of patterned optical channel waveguides and patterned electrical conductors co-exist in a single circuit board structure, with optical vias to transport light between different photonics layers and electrical vias to transport electrical signals and power between different electronics layers. An all-lithographic fabrication technology is used to build the entire board structure with mutually compatible planar processing steps. Novel techniques are used to produce channel optical waveguides connected to in-plane 45 degree turning mirrors and channel optical waveguides connected to optical vias with out-of-plane 45 degree turning mirrors. The mirrors can have either total internal reflection or metallized facets.